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Imaging Case of the Month
An Unusual Complication of Stapes Surgery

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Stapedectomy is a standard surgical treatment for clinically significant otosclerosis. In experienced hands, it delivers excellent functional results, with hearing improvement in more than 90% of the cases. Although the procedure has been celebrated through the years for its efficacy and safety, it is not devoid of complications but, fortunately, most of them are minor and self-limited (1). Still, the violation of the inner ear inherent to the technique has the potential to generate surgical disasters, leading to profound sensorineural hearing loss and incapacitating vertigo (1). The objective of this case report is to present a persistent postoperative complication of stapedectomy caused by an unusual surgical accident.

A 47-year-old woman came to our attention complaining of persistent positional vertigo and mild instability. The symptoms began immediately after right stapes surgery at another institution 6 months before. Although reporting a good hearing result, she was distressed with the chronic imbalance/instability, which persisted even after 3 months on vestibular suppressants and vestibular rehabilitation. Physical examination revealed an intact tympanic membrane and a positive Rinné test in both ears. The Dix-Hallpike test was positive for subjective vertigo and geotropic torsional nystagmus in the head-right position. An audiogram in the operated ear showed moderate low- and high-frequency sensorineural loss, with normal thresholds in the mid-range frequencies and closure of the air-bone gap (Fig. 1, A and B). A computed tomography (CT) scan revealed a clear middle ear with an apparently well-positioned prosthesis from the incus to the oval window. Surprisingly, CT also revealed prolapse of the entire stapes into the vestibule (Fig. 2, A and B). The footplate was found close to the medial wall of the vestibule, filling almost completely the saccule spherical recess. Three sessions of particle repositioning maneuvers were carried out without improvement of the symptoms. After careful discussion with this patient, it was decided to continue vestibular physical therapy given her adequate hearing levels. A surgical attempt to rescue the stapes from the vestibule was considered but was felt to carry an unacceptable risk of damaging the membranous labyrinth, with possible ominous additional consequences for the patient's hearing and balance.

In a literature review, we were unable to find any reported case of complete stapes luxation into the vestibule during stapedectomy. There is one case report of a stapes prosthesis dislocation into the vestibule (2) and a few cases of traumatic (nonsurgical) stapes subluxation into the vestibule (3,4). The presence of a complete stapes inside the vestibule was a unique finding in this patient, who retained near-normal hearing after such a bizarre surgical accident. The preservation of hearing in this case attests to the resilience of this patient's labyrinth to the surgical insult. It is interesting to note that the dislodged stapes was deep within the vestibule possibly abutting the saccule. As a potential consequence, we would expect significant damage to the hearing function but, surprisingly, this was not the case.

It is unknown what transpired to cause this type of injury because direct knowledge of the surgical events was not possible. It is assumed that excess force was placed on the stapes at some point during middle ear exploration, but it is unknown whether the prosthesis was positioned after or before subluxation of the stapes.

It is uncertain what types of offences can be incurred to the inner ear with retention of function and whether this differs among patients. Soft surgery for cochlear implantation, electroacoustic stimulation implants, and violations of the posterior semicircular canal for treatment of positional vertigo or during acoustic tumor removal are other circumstances where the inner ear may be violated with partial retention of function (5). On the other hand, there are situations where only minor insults are associated with an apparent disproportionate complete loss of hearing (spontaneous perilymphatic fistulas, opening the endolymphatic sac, profound deafness after uneventful

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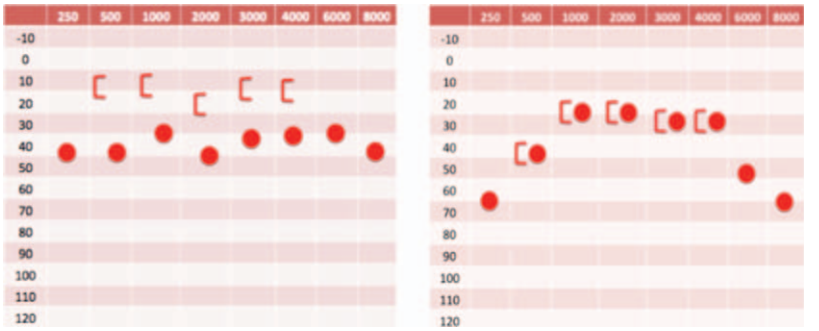

FIG. 1. *A*, Preoperative audiogram with a pure conductive hearing loss in the right ear. *B*, Postoperative audiogram showing a bell-shaped curve on the right side and closure of the air-bone gap.

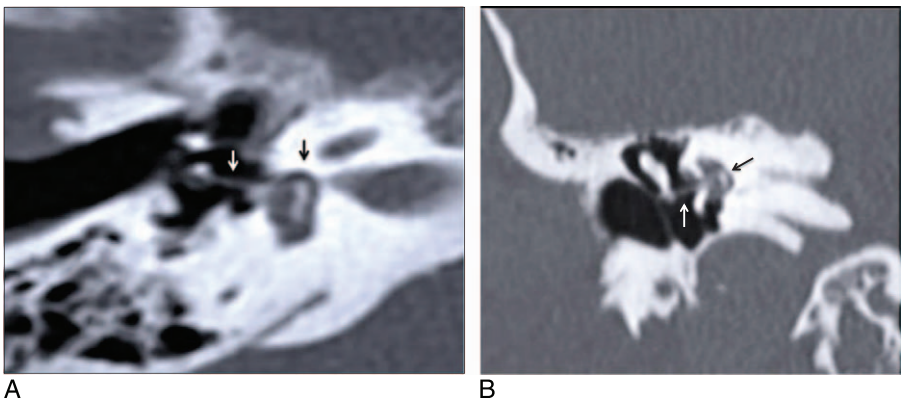

FIG. 2. *A*, Axial CT scan showing the presence of the stapes entirely in the vestibule *(black arrow)* and the stapes prosthesis in position *(white arrow)*. Interesting to note that the footplate is filling the spherical recess in the medial wall of the vestibule where the saccule is located. *B*, Coronal section showing another view of the presence of the stapes entirely in the vestibule *(black arrow)* and the stapes prosthesis in position *(white arrow)*.

middle ear surgery). What are the limits? What are the individual characteristics that make an ear prone (or not) to such catastrophes? These mysteries remain unanswered despite our current knowledge of inner ear pathophysiology.

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